NOSDRA
NATIONAL OIL SPILL DETECTION AND RESPONSE AGENCY

Gas Flare and Methane Emissions Detection in the Nigerian Oil and Gas Sector

Presented at the 2023 UN/Austria Symposium on Space for climate action:
Space Applications and Technologies for Sustainability on Earth

12-14 SEPTEMBER 2023 GRAZ, AUSTRIA & ONLINE

Panel 1: Energy and emissions

(Panel Discussion)

Time | 15:45

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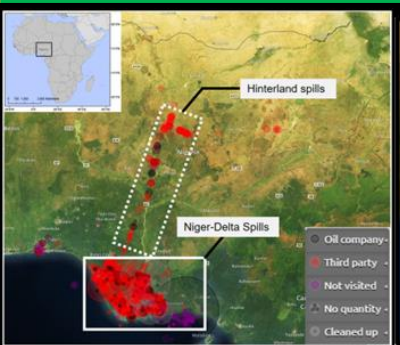


Basics of Gas Flares

Associated Gas Flaring: Why Should NOSDRA Care?

- **Gas flaring** is the burning of unwanted natural gas in oil wells. Globally, the practice has persisted since oil production started over 160 years ago. Operators in Nigeria are leading offenders, despite gas flaring being illegal since 2005. The toxic fumes cause many environmental and health problems, and the practice increases the risk of global warming. **Gas flaring** occurs due to poor regulation and commitment to tackle the problem.
- Recent Gas flaring satellite data reveals that Nigeria has remained one of the **top seven countries** emitters since 2012.

- **Learn if flaring is a chronic problem in your community or places you care about.**
- **Verify when petrochemical facilities flare.**
- **Hold companies accountable for wasting public and private resources through routine flaring.**
- **Inform public health research on the impacts of flaring on respiratory or other health issues.**
- **It essential for regulators to keep close tabs on the activity.**

- Nigeria flared 396 million standard cubic feet of gas from 2022 to August 2023, despite its commitment in November 2021 to reach net zero by 2060.

- About 21 million tons of **CO_2** were emitted into the atmosphere contributing to global warming while useful associated gas valued at **$1.4 billion USD** was flared by the Nigerian oil and gas industry in the same period. Equivalent in fines to the value of approximately **$791.9 million USD**, many of which have not been paid/collected.

WHY REMOTE SENSING FOR?

GAS FLARE/METHANE EMISSION TRACKING IN NIGERIA's OIL & GAS SECTOR?

- To provide/serve as:
  - ✓ an alternative and independent means of detection, measurement and quantification of **gas flare** and **methane emission** for the Federal Government of Nigeria devoid of human distortion.
  - ✓ a **reliable and scientific** source of emission data that complement's the supposed metering approach.
- To enable Nigerians find out and see how big the problem of gas flare and methane emission is, which

"depends on what is needed"

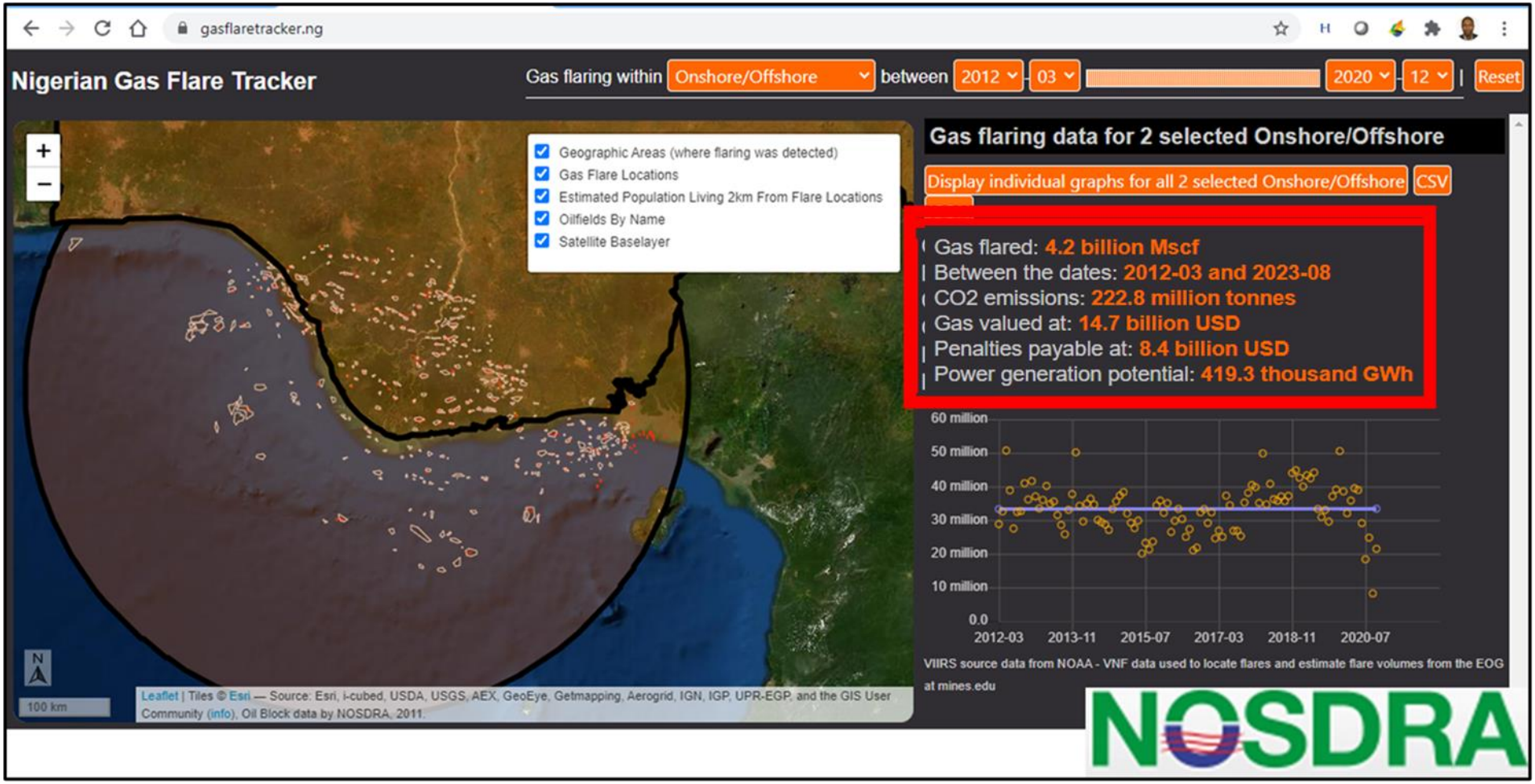
- **A bottom-up approach** mainly focuses on using emission factors to generate emissions inventories. These inventories are based on estimated emissions and not detection and quantification.
- **A top-down approach** uses methane concentration data from larger areas to identify and quantify emission sources. Several top-down remote sensing technologies, such as LIDAR, aircraft, and satellites, are available.

High-resolution satellite technology is efficient and cost-effective. Why?

- Satellites can identify large leaks and help with ground activity prioritization.
- Provides frequent monitoring for all your sites.
- Satellite technology is proven effective and **here to stay**.
- Satellites can detect 100 kg/hr emissions in moderate wind conditions and can even attribute emissions to specific facilities onshore and offshore from space.

The Nigerian Gas Flare Tracker (NGFT)

The Nigerian Gas Flare Tracker (GFT) platform is one of NOSDRA's **key organisational assets for effective operation** that warehouses **data** on gas flaring onshore and offshore of Nigeria.

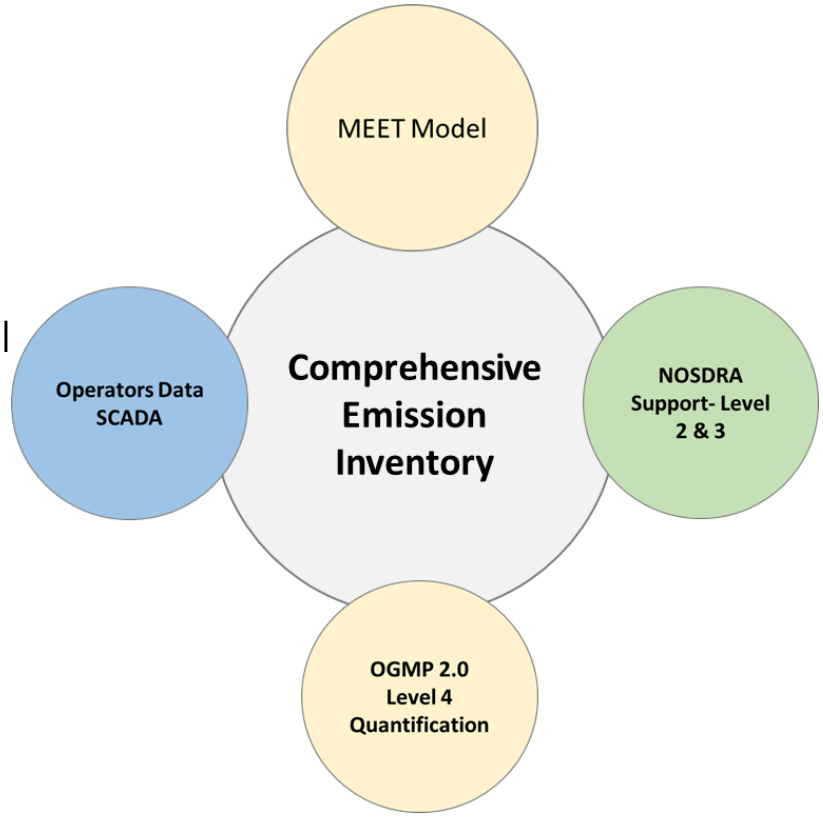


https://gasflaretracker.ng/

Multi-Scale Measurement Process

Sub sampling

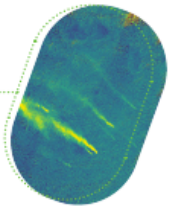
- Satellite, Drone/Methane sensor
- Building accurate distribution of site-level facility measurements



Country-wide summary

- Mass flux
- Quantification of non-operated assets in mass flux
- Quantification of variable, non-production sources (Onshore & Offshore).

DATA.SAT PRODUCTS



ABUNDANCE DATASET
Multi-layer GEOTIFF containing per-pixel methane concentration data, including surface reflectance image.

CONCENTRATION MAP
Visualization layer of methane emission overlaid on ground imagery, includes surface reflectance, column density and estimated excess foreground density (see example above).

EMISSION RATES
Cutting-edge retrieval methods to infer emission rate estimates from high-resolution concentration data.

GHGSAT DATA ARCHIVE
A catalogue of all the available data. Request a data product by time period and region for analysis and research.

Opportunities for Collaboration

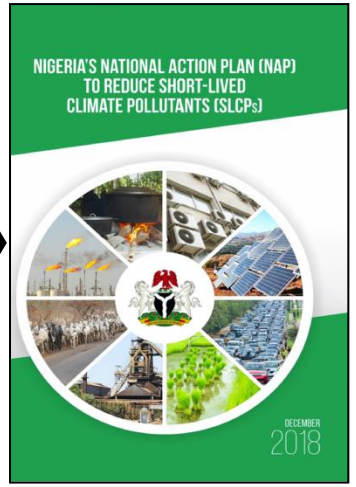
Face the data. Change Nigeria.

Call for a Hybrid Data Gathering Approach

NOSDRA is set to crunch the numbers, go over every last detail to detect and measure emissions (CO_2 and CH_4) from the oil and gas sector using satellite technology for a better Nigeria.

The Nigerian Gas Flare Commercialization Programme (NGFCP) can benefit immensely from the data provided by the GFT, to guide in the valuation of each flare stack and business planning for prospective buyers .

We must keep in mind that **data is the basis of tracking the Short-Lived Climate Pollutant (SLCP)**, reducing emissions and the implementation of the Emission Trading Scheme to actualize the Carbon Tax of Climate Act, 2021. Hence streamlining the data from the GFT platform the Methane Tracker to meet **tier 2 and 3** (i.e., IPCC emission data grade is germane) and on this, NOSDRA is committed to providing this important data to enforce regulatory compliance by industry.



Through Institutional Collaboration

Thank You/vielen Dank

??--QUESTIONS--??

2012

Burning an estimated **362.6 million Mscf** over **10** of the **10** months between **2012-03** and **2012-12**.
CO_2 emissions: **19.1 million tonnes**
CH_4 burned: **7.0 million tonnes**
Gas value: **906.4 thousand USD** @ **0.0025** USD/Mscf
Penalties: **1.3 million USD** @ **0.0035** USD/Mscf
Power generation potential: **46.0 billion kWh**

2013

Burning an estimated **424.1 million Mscf** over **12** of the **12** months between **2013-01** and **2013-12**.
CO_2 emissions: **22.4 million tonnes**
CH_4 burned: **8.2 million tonnes**
Gas value: **1.1 million USD** @ **0.0025** USD/M
Penalties: **1.5 million USD** @ **0.0035** USD/M
Power generation potential: **53.9 billion kWh**

2014

Burning an estimated **391.4 million Mscf** over **12** of the **12** months between **2014-01** and **2014-12**.
CO_2 emissions: **20.6 million tonnes**
CH_4 burned: **7.5 million tonnes**
Gas value: **1.0 million USD** @ **0.0025** USD/
Penalties: **1.4 million USD** @ **0.0035** USD/M
Power generation potential: **49.7 billion kWh**

2015

Burning an estimated **347.7 million Mscf** over **12** of the **12** months between **2015-01** and **2015-12**.
CO_2 emissions: **18.3 million tonnes**
CH_4 burned: **6.7 million tonnes**
Gas value: **869.2 thousand USD** @ **0.0025** USD/Mscf
Penalties: **1.2 million USD** @ **0.0035** USD/Mscf
Power generation potential: **44.2 billion kWh**

2016

Burning an estimated **347.3 million Mscf** over **12** of the **12** months between **2016-01** and **2016-12**.
CO_2 emissions: **18.3 million tonnes**
CH_4 burned: **6.7 million tonnes**
Gas value: **868.1 thousand USD** @ **0.0025** USD/Mscf
Penalties: **1.2 million USD** @ **0.0035** USD/Mscf
Power generation potential: **44.1 billion kWh**

2017

Burning an estimated **373.7 million Mscf** over **12** of the **12** months between **2017-01** and **2017-12**.
CO_2 emissions: **19.7 million tonnes**
CH_4 burned: **7.2 million tonnes**
Gas value: **934.3 thousand USD** @ **0.0025** USD/Mscf
Penalties: **1.3 million USD** @ **0.0035** USD/Mscf
Power generation potential: **47.5 billion kWh**

2018

Burning an estimated **471.0 million Mscf** over **12** of the **12** months between **2018-01** and **2018-12**.
CO_2 emissions: **24.8 million tonnes**
CH_4 burned: **9.1 million tonnes**
Gas value: **1.2 million USD** @ **0.0025** USD/Mscf
Penalties: **1.6 million USD** @ **0.0035** USD/Mscf
Power generation potential: **59.8 billion kWh**

2019

Burning an estimated **465.9 million Mscf** over **12** of the **12** months between **2019-01** and **2019-12**.
CO_2 emissions: **24.6 million tonnes**
CH_4 burned: **9.0 million tonnes**
Gas value: **1.2 million USD** @ **0.0025** USD/Mscf
Penalties: **1.6 million USD** @ **0.0035** USD/Mscf
Power generation potential: **59.2 billion kWh**

2020

Burning an estimated **353.5 million Mscf** over **12** of the **12** months between **2020-01** and **2020-12**.
CO_2 emissions: **18.6 million tonnes**
CH_4 burned: **6.8 million tonnes**
Gas value: **883.7 thousand USD** @ **0.0025** USD/Mscf
Penalties: **1.2 million USD** @ **0.0035** USD/Mscf
Power generation potential: **44.9 billion kWh**

2021

Burning an estimated **260.3 million Mscf** over **12** of the **12** months between **2021-01** and **2021-12**.
CO_2 emissions: **13.7 million tonnes**
CH_4 burned: **5.0 million tonnes**
Gas value: **650.7 thousand USD** @ **0.0025** USD/Mscf
Penalties: **911.0 thousand USD** @ **0.0035** USD/Mscf
Power generation potential: **33.1 billion kWh**

2022

Burning an estimated **224.9 million Mscf** over **12** of the **12** months between **2022-01** and **2022-12**.
CO_2 emissions: **11.9 million tonnes**
CH_4 burned: **4.3 million tonnes**
Gas value: **562.3 thousand USD** @ **0.0025** USD/Mscf
Penalties: **787.2 thousand USD** @ **0.0035** USD/Mscf
Power generation potential: **28.6 billion kWh**

2023

Burning an estimated **151.3 million Mscf** over **7** of the **7** months between **2023-01** and **2023-07**.
CO_2 emissions: **8.0 million tonnes**
CH_4 burned: **2.9 million tonnes**
Gas value: **378.3 thousand USD** @ **0.0025** USD/Mscf
Penalties: **529.7 thousand USD** @ **0.0035** USD/Mscf
Power generation potential: **19.2 billion kWh**

2012 - 2023

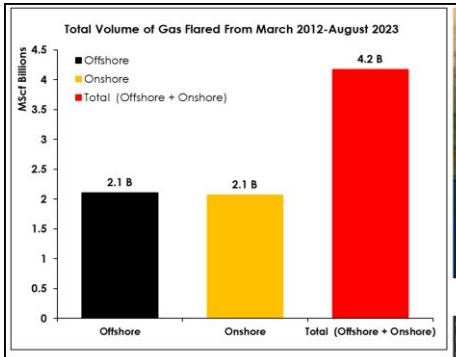
Burning an estimated **4.2 billion Mscf** over **137** of the **137** months between **2012-03** and **2023-07**.
CO_2 emissions: **220.1 million tonnes**
CH_4 burned: **80.2 million tonnes**
Gas value: **10.4 million USD** @ **0.0025** USD/Mscf
Penalties: **14.6 million USD** @ **0.0035** USD/Mscf
Power generation potential: **530.1 billion kWh**

Gas Flare Penalty Regimes and Years

$0.30 per 1,000 standard cubic feet (scf) 2012- June 2018

$2 per 1,000 standard cubic feet (scf) - July 2018 to date

Computation based on legislation the Flare Gas (Prevention of Waste and Pollution) Regulations of 2018



Overview of Satellite Detection and Measurement of Gas Flare Volumes from Oil and Gas Assets offshore and onshore Nigeria (2012-2023).
Source: Nigerian Gas Flare Tracker Platform (https://gasflaretracker.ng/)

Gas flared: **4.2 billion Mscf**
Between the dates: **2012-03 and 2023-07**
CO2 emissions: **221.7 million tonnes**
Gas valued at: **14.6 billion USD**
Penalties payable at: **8.3 billion USD**
Power generation potential: **417.4 thousand GWh**